DISEASE DETECTION IN VEGETABLE USING DEEP LEARNING TECHNIQUES

SHORT SYNOPSIS

Submitted in partial fulfillment of the requirement of the degree of

DOCTOR OF PHILOSOPHY

by

JASPREET KAUR
MRUCSDN012K210057

Under the supervision of

Dr. Shalu
Assistant Professor

Department of Computer Science and Technology
School of Engineering

MANAV RACHNA UNIVERSITY
Sector-43, Aravali Hills, Faridabad

2024

MANAV RACHNA UNIVERSITY

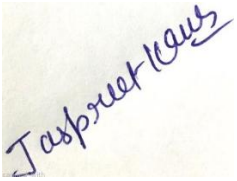
Sector-43, Aravali Hills, Faridabad

Date:16/03/2024

DECLARATION BY THE SCHOLAR

I hereby declare that the short synopsis entitled Disease Detection in Vegetable Using Deep Learning Techniques being submitted in partial fulfillment of the requirement for the degree of Doctor of Philosophy in the Department of Computer Science & Technology under the School of Engineering of Manav Rachna University, Faridabad during the academic year 2024.

It is the work that is being carried out under the supervision of Dr. Shalu. Further, it is declared that the short synopsis is within the plagiarism limit and copy of the same is attached as per the University norms.



Jaspreet Kaur

Registration Number

MRUCSDN012K210057

MANAV RACHNA UNIVERSITY

Sector-43, Aravali Hills, Faridabad

Date:16/03/2024

CERTIFICATE BY SUPERVISOR

This is to certify that, the short synopsis entitled Disease Detection in Vegetable Using Deep Learning Techniques is an original piece of work done by research scholar Ms. Jaspreet kaur. Under the supervision of Dr. Shalu for the degree of Doctor of Philosophy in the Department of Computer Science & Technology under the School of Engineering of Manav Rachna University, Faridabad during the academic year 2024.

Further, it is certified that the short synopsis is within the plagiarism limit and copy of the same is attached as per the University norms.

Supervisor

Dr. Shalu

Assistant Professor

Department Of Computer Science And Technology

Manav Rachna University

Table of Contents

1. ABSTRACT……4
2. INTRODUCTION……...5
3. LITERATURE REVIEW……...16
4. PROBLEM STATEMENT…….13
5. OBJECTIVES…….13
6. METHODOLOGY…….14
7. EXPECTED OUTCOMES…….15
8. REFERENCES……..…….16

Abstract

Vegetables are the indispensable ingredient for any nutritious diet. It should be used with caution to prevent them from becoming infected with any disease or infection. One of the most demanding fields of research that has drawn a lot of interest in the agriculture industry is in the field of vegetable disease identification and diagnosis. Since farming and agriculture are the main sources of income in India, most people rely on them for their nourishment. Based on the interpretation gained during the research, By hand-crafted feature extraction from the collected photographs, deep learning disease detection algorithms identify the kind of illness and incorporate the expert's painstaking observation of every vegetable during a field visit that is greatly delayed.

To overcome the obstacles farmers, confront, a Deep learning (DL) model is developed in this study, and is essential for identifying and detecting vegetable diseases.

According to the research, a deep learning-based technique is used for detecting vegetable disease using real time images are proposed. The main focus in this research is on onion and cassava with their several benefits. Using deep learning method, vegetable is classified into two categories i.e. healthy and diseased and it further be classified in (cassava brown and white spot, witches broom, cassava mites, onion purple blotch, basal rot, onion smut, onion yellow dwarf) effectively by applying framed rules.

The objective is to establish a foundation for detecting healthy and diseased vegetable images, as well as identifying disease types. DL algorithm is proved efficient in computing illness severity.

The suggested system is evaluated using both quantitative and qualitative methods to demonstrate its effectiveness in detection, categorization, and severity calculations. The proposed system will be compared with several existing systems in literature.

Keyword: - Deep learning, Healthy and Diseased, onion, qualitative and quantitative.

1. INTRODUCTION

Agriculture is crucial to the global economy, providing food, revenue, and job opportunities. Security of food and improving nutrition are part of the major protest facing by the agricultural sector. According to a study by the agriculture sector, vegetable infected with the disease will affect the whole yield. Identifying vegetable diseases is a major concern. Early identification of vegetable diseases can improve agricultural production management decisions. So, in this research focus on two vegetable cassava and onion. Traditional methods of vegetable disease detection requisite farmer to visually inspect and monitor their crops with the help of government funded agronomists. In addition, it is very labor intensive, time consuming, expensive and subject to production and delivery changes.

The automated disease diagnostic system is one of the agriculture's most advanced technologies. This method detects vegetable ailments by analyzing photos of infectious vegetable

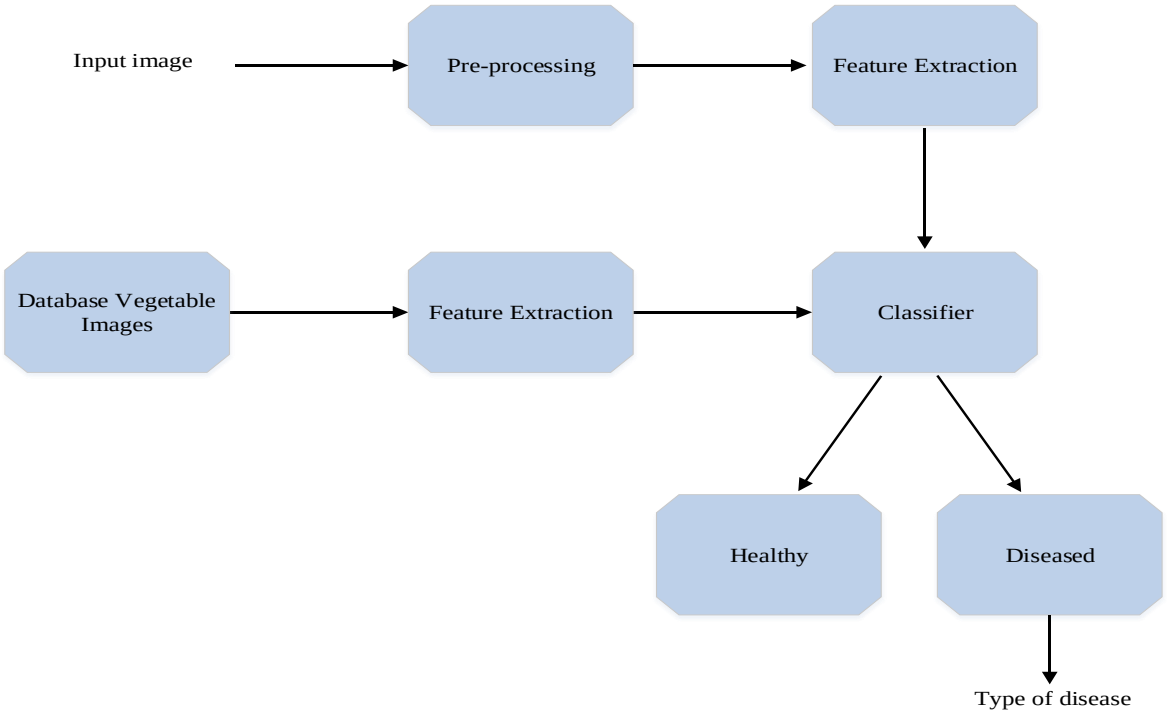


Figure 1. Flow chart of Vegetable Disease Diagnosis System

Diseases. It combines a mix of image pre-processing, feature extraction, classifier and a deep learning model to detect illnesses. It has been depicted in figure 1. Identifying vegetable diseases by human vision-based models has been time-consuming and costly in the past. These models depend on individual or specialized views to determine performance.

The automated vegetable disease diagnostics system simplifies the diagnostic procedure and enables farmers to make informed decisions regarding their vegetable's health. This may help farmers use resources more efficiently and increase agricultural productivity. By focusing on vegetable image category approaches based on the practice of deep learning techniques on real time dataset.

The goal of this initiative is to forecast onion and cassava illness and identify the disease for prevention. To uncover these characteristics, we use deep learning to forecast which disease is more uncertain and which should be emphasized the most to avoid onion and cassava illness. The main objective is to detect onion and cassava disease using deep learning and provide farmers with viable remedies.

2. LITERATURE REVIEW

Nihar et.al [1] proposes a four deep learning techniques DenseNet121, VGG19 CNN, EfficientNetB3, and ResNet50, out of these models EfficientB3 model proved to be satisfactory and achieved 98% accuracy. These models are used for early diagnosis of cauliflower diseases. It is anticipated that these results will direct the creation of sophisticated agricultural monitoring and tools for decision-making.

According to the author Prakash et.al [2], deep learning models are used for early identification of cauliflower diseases. The highest accuracy achieved by VGG-16 is 96%. This is a huge advancement in the battle against illness and the manufacturing of high-quality products to meet global demand.

Author zihan et.al proposed a Litemixer model. This work highlights LiteMixer model effectiveness and usefulness in addressing the particular difficulties related to cauliflower disease identification in the area of computer vision methods, positioning it as a cutting-edge solution for identifying cauliflower leaf illnesses in agricultural environments. LiteMixer has the greatest accuracy with a 99.86% accuracy rate in diagnosing cauliflower illnesses.

As onion is very common in agriculture industry. Laurence et.al [4] have used different CNN models InceptionV3, ResNet-50 and VGG-16 . All these models are used to detect the status of

the health and nutrient deficiency in onions. When compared the workings of these models, VGG-16 has achieved the best accuracy i.e. 85% in detecting macro-nutrient deficiency in onion.

According to the research by the author, machine learning CNN model were implemented to detect the diseases in potato leaf. Experimental results which were proposed by Riya et.al [5] with different approach to classify vegetable leaf diseases i.e. early blight, late blight ,and the leaves are mainly distinguished as healthy and diseased. The model achieves 97% accuracy in detecting potato disease. Economic loss will be reduced after achieving this accuracy rate.

According to swati et.al [6] research, Traditional machine learning algorithm are used as classifier and many CNN models are used to detect disease in potato plant but SVM(support vector machine) has achieved 93% accuracy in comparison with other models. This study mainly focuses on healthy and unhealthy disease leaf detection in potato.

Tomato is perhaps the most significant crop worldwide. It can be effected by many climatic conditions but Author utpal et.al [7] has introduced deep CNN approach to find the solution for farmer to diagnose tomato leaf disease using this approach and achieve the best results in identifying tomato leaf disease. When compared with other models it provides early detection of disease and achieve 82% accuracy.

Rathika et.al [8] proposes a method which accurately detects the disease and author focuses on only three diseases mosaic, leaf mould and curl virus. The model KNN achieves the 90% in detecting the tomato leaf disease detection. This paper explains implementation of thresholding technique and provides the early detection of diseases.

According to the author, rahul et.al[9] has proposed a CNN technique. InceptionResNetV2 is used in CNN model to identify the cassava leaf diseases. Several cassava diseases were detected by using this model. The diseases include Bacterial Blight, Green Mite, Mosaic Disease, Brown Steak Disease, and Healthy and to detect these diseases InceptionResNetV2 achieves 87% accuracy.

According to the author sowjanya et.al [10] proposed an enhanced version of CNN technique has implemented on the large datasets to detect diseases in fruits , pulses and vegetables which introduced 3 classes and 12 diseases and achieve 93% accurate predictions in detecting diseases. Segmentation and image processing technique has been used in achieving the best accuracy.

Nagamani et.al [11] proposes different CNN models to detect tomato leaf diseases i.e. R-CNN, fuzzy SVM and CNN. These model have proposed and is able to detect six diseases of tomato leaf but the most extra ordinary model is R-CNN classifier achieves accuracy is 96%.

Vegetables are very crucial in our daily life. Vemakoti et.al [12] mainly focus on tomato leaf vegetable and proposes a CNN approach in detecting tomato leaf disease using machine learning and achieves 91% accuracy in detecting leaf disease. Proposed approach also classifies healthy and unhealthy tomato leaf. Unhealthy leaf are further classified in to nine diseases of tomato leaf. According to katiki et.al [13] research, many deep learning models were introduced and CNN related to deep neural networks has been implemented on plant village dataset and achieve the highest accuracy i.e. 98% to identify diseases in potato leaves.

Zubair et.al [14] proposed a deep CNN technique because CNN technique is better than many traditional machine learning model to find the best accuracy. Two technique has been used i.e. ResNet-152 and inceptionv3 has been introduced to achieve 98% & 95% accuracy at learning rate 0.0005. The proposed technique has three classes potato early and late blight and a healthy leaf to recognize disease in potato leaf.

According to author, Sultana et.al [15] proposed a model using deep learning to find out different diseases in tomato plant leaf using VGG-16 model. Our proposed model shows 100% accuracy in differentiating healthy and unhealthy leaves without segmentation and preprocessing.

Author alina et.al [16] has proposed an EfficientNet b4 technique which was trained by transfer learning approach. This technique was introduced to detect cassava leaf disease using kaggle dataset and experimental results shows the good accuracy i.e. 81% in detecting cassava leaf disease detection.

Cassava is the vegetable that is majorly used in Indonesia with all the benefits. According to the author[17] Rafi et.al proposes a deep learning CNN technique to detect the illness in cassava leaf. With large dataset CNN technique will be implemented and achieve 74% accuracy in detecting the type of diseases of cassava leaf.

According to garima et.al [18] , author have proposed a CNN based image processing technique to detect different diseases in the leaves of tomato and the testing achieved good accuracy of 88.8%. The python software is used for processing this technique.

Mamta et.al [19] proposes different deep CNN architectures to detect diseases in tomato leaf. There are several deep learning techniques, which are proposed for detection in tomato leaf disease. The proposed technique used GoogleNet, DenseNet, VGG16, ResNet-101 & AlexNet from which DenseNet-121achieves the highest accuracy rate i.e. 98%.

Marwan et.al [20] has demonstrated a systematic CNN deep learning technique to detect many type of leaf diseases of different vegetables by using plant village dataset. Diseases includes 12 diseases such as early blight, mosaic, late blight, and 3 classes of healthy leaves.

Author ahmed zaki[21] et al proposed a deep learning model i.e. InceptionV3 technique achieves an accuracy of 85% by using plant village dataset. An enhanced InceptionV3 model is trained for detecting onion leaf disease i.e. purple blotch. This disease is the most serious and very common in onion leaf. So, to detect this disease, an inceptionv3 technique is implemented and achieves the good accuracy in detecting Purple Blotch.

Ding jiang et.al [22] proposed a CNN technique to detect tomato leaf diseases. Author used deep learning technique i.e. ResNet-50 as the base model and achieves the best accuracy i.e. 98%.

Nithish et.al [23] proposed a deep CNN model using ResNet-50 technique to identify the diseases in tomato leaf and this technique achieved 97% accuracy. This model was established using PyTorch. Data set has been increased by 4 times the original dataset by using data augmentation.

Rizqi et.al [24] proposed a Deep CNN technique i.e. VGG16 and VGG19 achieves the 91% accuracy and identify the disease which affect the potato leaf. The result, which is obtained from the proposed technique, is completely accurate.

Potatoes are significant vegetable in India. Author Khalid et.al[25] proposed five algorithm LeNet, ResNet, sequential, VggNet and AlexNet. Diseased and healthy leaf is classified by these algorithms and achieve 96% accuracy. Model proposed by the author detect diseases using machine-learning algorithm.

According to the author wan-soo et al [26], proposes a deep learning model to detect onion leaf disease by using real time dataset and it includes six classes. The proposed technique detects onion downy disease and achieves an 87% accuracy.

Meghna et.al [27] proposed different machine learning techniques like SVM, decision tree ,logistic regression, K-nearest neighbors and Random forest to detect the different diseases of tomato leaf. The Random forest technique performance achieved the highest accuracy i.e. 95%.

Manpreet et.al [28] according to the study, author used Resnet technique of deep learning. The experimental results shows the correct disease detection of tomato leaf. The image, which was selected, is based on the disease category and achieves 100% accurate results.

Prajwala et.al [29] proposed a deep CNN approach to detect many diseases in tomato. The author has demonstrated LeNet. This deep learning technique performed well and achieves accuracy of

94%. Three stages have been performed: Data acquisition, Data preprocessing and classification to achieve the best accuracy.

Jia et.al [30] proposed a CNN based technique i.e. VGG16+ SVM methodology that achieves the best accuracy. These two deep learning based techniques achieves real time performance with 89% accuracy. Proposed model is using deep learning technique and trained with keras/tensorflow. Comparative Analysis of vegetable Diseases Detection Techniques has been described in Table 1.

Table 1 Comparative Analysis of vegetable Diseases Detection Techniques

Author	Year	Dataset	Vegetable	Diseases	Algorithm	Accuracy
Nihar et.al[1]	2024	Farmland	Cauliflower	Downy mildew, bacterial spot rot, black rot and healthy	EfficientNetB3	98%
Prakash et.al[2]	2024	Plant village dataset	Cauliflower	White rust, damping off, club root.	VGG-16	96%
Zihan et.al[3]	2024	Plant village dataset	Cauliflower	Bacterial spot, healthy, downy mildew, black rot	LiteMixer	99%
Laurence et.al[4]	2024	Plant village dataset	Onion	Macro-nutrient	VGG16	85%
Riya verma et.al[5]	2023	Plant village dataset	Potato	Late And Early Blight	CNN	97%
Swati et.al[6]	2023	Plant village dataset	Potato	Early And Late Blight	SVM	93%
Utpal et.al[7]	2023	Plant village dataset	Tomato	Early blight ,Leaf curl and healthy	CNN	82%
Rathika et.al[8]	2023	Plant village dataset	Tomato	Mosaic, leaf mold and curl viruses	KNN	90%

Rahul et.al[9]	2023	Plant village dataset	Cassava	Cassava brown streak, mosaic, Green mite and healthy	InceptionResNetV2	87%
Sowjanya et.al[10]	2022	Plant village dataset	Pulse, fruit, vegetable	All diseases	CNN	93%
Nagamani et.al[11]	2022	Plant village dataset	Tomato	Early blight, curl, mosaic ,leaf mold, leaf, septoria leaf spot, target spot	CNN	96%
Vemakoti et.al[12]	2022	Plant village dataset	Tomato	Early blight, leaf curl, septoria leaf spot, target spot, mosaic, leaf mold	CNN	91%
Katiki et.al[13]	2022	Plant village dataset	Potato	9 diseases and 1 healthy	CNN	97%
Zubair et.al[14]	2021	Kaggle dataset	Potato	Early blight and late blight	ResNet, InceptionV3	98%,95%
Sultana et.al[15]	2021	Plant village dataset	Tomato	Target spot, septoria leaf spot, spider mites, mosaic, yellow leaf, leaf mold, early & late blight	InceptionV3	85%
Alina et.al[16]	2021	kaggle	Cassava	Cassava mosaic, ,brown streak, Green mite ,brown& white leaf spot and healthy	EfficientNet	81%
Rafi et.al[17]	2021	Plant village dataset	Cassava	Cassava brown streak, mosaic, Green mite ,brown& white leaf spot and healthy	CNN	74%

Garima et.al[18]	2020	Plant village dataset	Potato, Tomato	Bacterial spot, leaf curl, leaf mold, septoria leaf spot early and late blight	CNN	88.8%
Mamta et.al[19]	2020	Plant village dataset	Tomato	Yellow leaf curl, bacterial spot, leaf mold, spider mite, mosaic, early and late blight	VGG16, GoogleNet, DenseNet-121, ResNet-101	89%
Marwan et.al[20]	2020	Plant village dataset	Bell pepper, potato, tomato	Fungi and Bacteria	CNN	98%
Ding jiang et.al[21]	2020	Plant village dataset	Tomato	Yellow leaf curl, spot blight and late blight	ResNet-50	98%
Huiquin et.al[22]	2020	Plant village dataset	Tomato	Powdery mildew, leaf mold, target spot	DenseNet, ShuffleNet	96%, 83%
Nithish et.al[23]	2020	Plant village dataset	Tomato	Bacterial spot, yellow leaf curl, mosaic, early blight, septoria leaf spot.	ResNet-50	87%
Rizqi et.al[24]	2020	Plant village dataset	Potato	Dead spot and healthy	VGG16 & VGG19	91%
Khalid et.al[25]	2020	kaggle	Potato	Early blight, septoria leaf spot, late blight	AlexNet, VggNet, ResNet,LeNet	97%
Wan-soo et.al[26]	2020	Real time dataset	Onion	Onion downy-mildew	Deep learning model	87%

Meghna et.al[27]	2019	Plant village dataset	Tomato	Spider mite, target spot, mosaic, yellow leaf curl, early blight, healthy,septoria leaf spot, late blight	Random forest	95%
Manpreet et.al[28]	2019	Plant village dataset	Tomato	Leaf mold, leaf curl, mosaic, target spot, early blight and late blight and healthy	ResNet	98%
Prajwala et.al[29]	2018	Plant village dataset	Tomato	yellow leaf curl ,septoria leaf spot, and healthy	leNet	94%
Jia et.al[30]	2017	Plant village dataset	Tomato	10 tomato diseases	CNN	89%

3. PROBLEM STATEMENT

Vegetable disease is the major calamity in the field of agriculture, which defeat the evolution of agriculture field and leave the farmer with significant financial loss. In this research, the focus is on onion and cassava. There are many diseases, which affect the onion. 1. Onion blight 2. Basal rot 3. Downy mildew 4. Black mold 5. Smudge 6. Bacterial brown rot 7. Onion yellow dwarf and there are many diseases which affect cassava as well 1.Brown spot 2. White spot 3. Witches broom 4. Mosaic disease 5. Brown streak disease 6. Bacterial Blight 7. Cassava Mites. These diseases affect the vegetable from the root of the leaf. To avoid significant losses in agricultural productivity and preserve food security, early identification and efficient control of these diseases are essential. Detecting the type of the disease is the most significant problem. Therefore, this study will demonstrated how to prevent vegetable from these diseases and gives the possible solutions.

4. OBJECTIVES OF THE STUDY

The following are the objectives which are derived to overcome the problems:-

1. Conduct a pilot literature survey to identify diseases in different vegetables.
2. Analyze datasets of vegetable images for feature extraction and classification to distinguish between healthy and diseased plants.

3. Design and implement a technique for identifying the disease in vegetable using appropriate deep learning techniques.
4. To compare proposed deep learning technique with the existing technique based on different parameters such as F1 score, Recall, precision and accuracy.

5. METHODOLOGY TO BE ADOPTED

This work is based on Deep learning technology to detect the type of disease. The deep learning system also guarantees the highest level of accuracy while identifying the kind of diseases in vegetables as shown in Figure 2. Data set import- Data is the main component of this project. Since, working with an image dataset, must gather an extensive set of pictures. Therefore, when gathering photographs, we need to be mindful of certain crucial factors including image sizes, resolutions, and quality, as well as the symptom associated with the damaged vegetable. Pre-processing- To obtain a clean leaf sample, the problematic leaf picture's background is first removed before proceeding with any more processing. It assists in eliminating a variety of problems, such as lighting, sharpness effects, and problems with insufficient contrast. Evaluate model- The performance of deep learning technique are used to gauge the model's performance. This study's assessment techniques are all predicated on four factors. These four factors are F1 score, Recall, precision and accuracy.

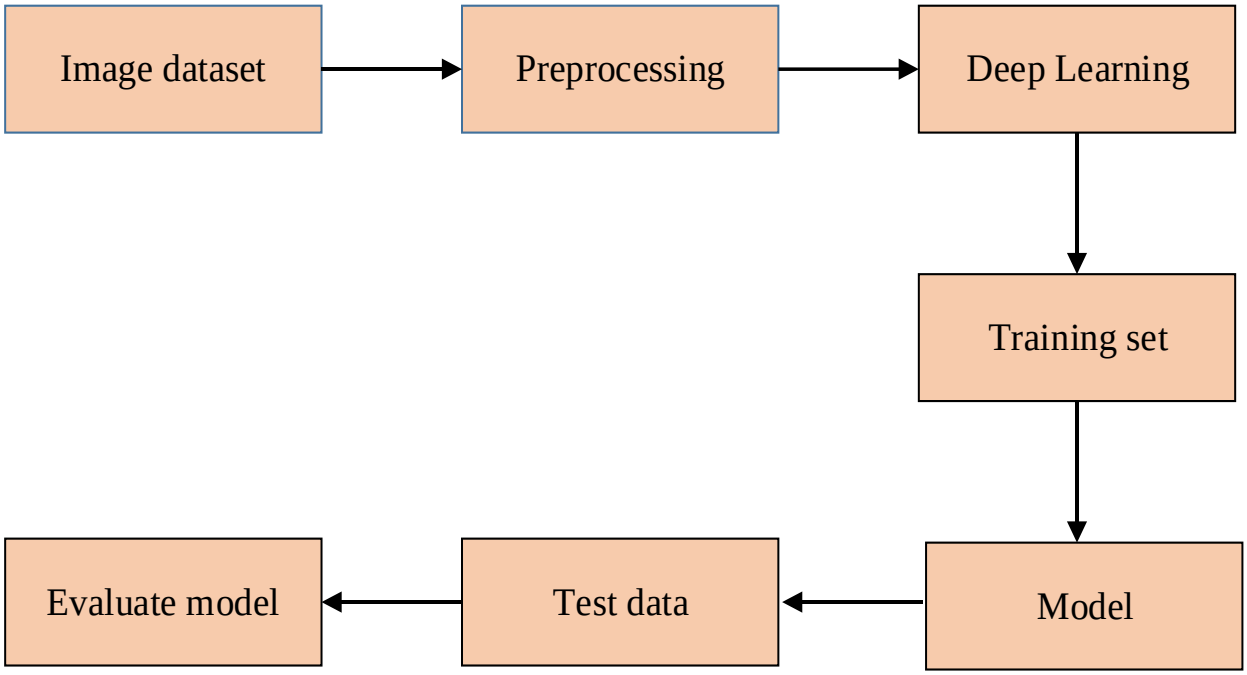


Figure 2 Proposed Model Using Deep-Learning Technique

6. EXPECTED OUTCOMES OF THE RESEARCH

Crop production is a major factor in a nation's economy. The most crucial element in the creation of food is crops. Good yields come from healthy plants. If the plants are contaminated, this might have an adverse effect on food output. A vegetable disease can be detected by a change in the vegetable color or even form. Therefore, it becomes crucial to early identify plant illnesses to prevent any impact on food supply. The expected outcomes of this research are as follows:-

- Best accuracy: - Proposing new deep learning methods for detecting vegetable disease with highest accuracy percentage. Diseases like Onion smut, onion purple blotch, onion soft rot, cassava mites, Witches broom etc. that makes the plants in the worse condition.
- Categorize healthy and unhealthy diseases: - Healthy and unhealthy leaf will be categorize by using deep learning methods. If some part of the vegetable is infected, it will show the type of the disease and if there is no infection then those vegetable are healthy.
- Predicting diseases: - Detecting diseases using deep learning methods. Disease will be detected by uploading the image or a group of images.
- Comparative accuracy: - Proposed technique will be implemented and compared with other techniques.

References

1. Pradhan, Nihar, Hritwik Ghosh, Irfan Rahat, Janjhyam Ramesh, and Mannava Yesubabu. "Enhancing Agricultural Sustainability with Deep Learning: A Case Study of Cauliflower Disease Classification." *EAI Endorsed Transactions on Internet of Things* 10 (January 12, 2024). https://doi.org/10.4108/eetiot.4834.
2. Parmar, Prakash J., and Mukesh Shrimali. "Identification of Fruit Severity and Disease Detection Using Deep Learning Frameworks." *International Journal of Intelligent Systems and Applications in Engineering* 12, no. 12s (January 12, 2024): 288–95.
3. Zhong, Yi, Zihan Teng, and Mengjun Tong. "LiteMixer: Cauliflower Disease Diagnosis Based on a Novel Lightweight Neural Network." *The Computer Journal*, February 2, 2024, bxae010. https://doi.org/10.1093/comjnl/bxae010.
4. Navarro, Laurence Kobe B., Kristin Clarisse H. Mateo, and Cyrel O. Manlises. "CNN Models for Identification of Macro-Nutrient Deficiency in Onion Leaves (Allium Cepa L.)." In *2023 IEEE 5th Eurasia Conference on IOT, Communication and Engineering (ECICE)*, 396–400, 2023. https://doi.org/10.1109/ECICE59523.2023.10383126.

5. Verma, Riya, Rahul Mishra, Prachi Gupta, Pooja, and Shivani Trivedi. "CNN Based Leaves Disease Detection in Potato Plant." In *2023 6th International Conference on Information Systems and Computer Networks (ISCON)*, 1–5, 2023. https://doi.org/10.1109/ISCON57294.2023.10112080.
6. Sahu, Swati Laxmi, and Renta Chintala Bhargavi. "Prediction of Diseases in Potato Plant Using Pre-Trained and Traditional Machine Learning Models." In *2023 4th International Conference for Emerging Technology (INCET)*, 1–8, 2023. https://doi.org/10.1109/INCET57972.2023.10170149.
7. Singh, Utpal Kant, Rajnish Kumar, Saurabh Kumar, Shibasish Kar, and Santos Kumar Baliarsingh. "Detection of Diseases in Tomato Plants Using Convolutional Neural Network." In *2023 14th International Conference on Computing Communication and Networking Technologies (ICCCNT)*, 1–6, 2023. https://doi.org/10.1109/ICCCNT56998.2023.10307329.
8. Vini, S. Ledbin, and P. Rathika. "Thresholding Based Tomato Leaf Disease Classification." In *2023 4th International Conference on Signal Processing and Communication (ICSPC)*, 143–47, 2023. https://doi.org/10.1109/ICSPC57692.2023.10125865.
9. Singh, Rahul, Avinash Sharma, Neha Sharma, Kulbhushan Sharma, and Rupesh Gupta. "A Deep Learning-Based InceptionResNet V2 Model for Cassava Leaf Disease Detection." In *Emerging Trends in Expert Applications and Security*, edited by Vijay Singh Rathore, Vincenzo Piuri, Rosalina Babo, and Marta Campos Ferreira, 423–32. Lecture Notes in Networks and Systems. Singapore: Springer Nature, 2023. https://doi.org/10.1007/978-981-99-1946-8_38.
10. Sowjanya, R., T. Lakshmi Prasanna, P. Ashwak Khan, P. Ranga Rao, and C.S.S. Anupama. "Detection Of Leaf Diseases in Pulses, Fruits and Vegetables." In *2022 8th International Conference on Advanced Computing and Communication Systems (ICACCS)*, 1:880–84, 2022. https://doi.org/10.1109/ICACCS54159.2022.9785295.
11. "Tomato Leaf Disease Detection Using Deep Learning Techniques." *International Journal of Advanced Computer Science and Applications* 13, no. 1 (2022).
12. Chaitanya, Vemakoti Santosh Krishna, Datti Rakesh, Sachikanta Dash, Bidush Kumar Sahoo, Sasmita Padhy, and Mamata Nayak. "Tomato Leaf Disease Detection Using Neural Networks." In *2022 International Conference on Machine Learning, Computer Systems and Security (MLCSS)*, 53–58, 2022. https://doi.org/10.1109/MLCSS57186.2022.00018.
13. Krishna, Katiki Sai, and Gurugubelli V S Narayana. "Early Blight and Late Blight Disease Prediction Using CNN for Potato Leaves." In *2022 Second International Conference on Computer Science, Engineering and Applications (ICCSEA)*, 1–6, 2022. https://doi.org/10.1109/ICCSEA54677.2022.9936100.
14. Saeed, Zubair, Misha Urooj Khan, Ali Raza, Nazish Sajjad, Sana Naz, and Ahmad Salal. "Identification of Leaf Diseases in Potato Crop Using Deep Convolutional Neural Networks (DCNNs)." In *2021 16th*

International Conference on Emerging Technologies (ICET), 1–6, 2021. https://doi.org/10.1109/ICET54505.2021.9689807.

15. Kathiravan, M., K.Hari Priya, S. Sreesubha, A. Irumporai, V.Sukesh Kumar, and Vishnu Vardhan Reddy. "ML Algorithm-Based Detection of Leaf Diseases." In *2022 4th International Conference on Smart Systems and Inventive Technology (ICSSIT)*, 1396–1400, 2022. https://doi.org/10.1109/ICSSIT53264.2022.9716430.
16. Habiba, Sultana Umme, and Md. Khairul Islam. "Tomato Plant Diseases Classification Using Deep Learning Based Classifier From Leaves Images." In *2021 International Conference on Information and Communication Technology for Sustainable Development (ICICT4SD)*, 82–86, 2021. https://doi.org/10.1109/ICICT4SD50815.2021.9396883.
17. Zaki, Muhammad Ahmed, Sanam Narejo, Muhammad Ahsan, Sammer Zai, Muhammad Rizwan Anjum, and Naseer u Din. "Image-Based Onion Disease (Purple Blotch) Detection Using Deep Convolutional Neural Network." *International Journal of Advanced Computer Science and Applications (IJACSA)* 12, no. 5 (58/31 2021). https://doi.org/10.14569/IJACSA.2021.0120556.
18. Maryum, Alina, Muhammad Usman Akram, and Anum Abdul Salam. "Cassava Leaf Disease Classification Using Deep Neural Networks." In *2021 IEEE 18th International Conference on Smart Communities: Improving Quality of Life Using ICT, IoT and AI (HONET)*, 32–37, 2021. https://doi.org/10.1109/HONET53078.2021.9615488.
19. Surya, Rafi, and Elliana Gautama. "Cassava Leaf Disease Detection Using Convolutional Neural Networks." In *2020 6th International Conference on Science in Information Technology (ICSITech)*, 97–102, 2020. https://doi.org/10.1109/ICSITech49800.2020.9392051.
20. Shrestha, Garima, Deepsikha, Majolica Das, and Naiwrita Dey. "Plant Disease Detection Using CNN." In *2020 IEEE Applied Signal Processing Conference (ASPCON)*, 109–13, 2020. https://doi.org/10.1109/ASPCON49795.2020.9276722.
21. Gehlot, Mamta, and Madan Lal Saini. "Analysis of Different CNN Architectures for Tomato Leaf Disease Classification." In *2020 5th IEEE International Conference on Recent Advances and Innovations in Engineering (ICRAIE)*, 1–6, 2020. https://doi.org/10.1109/ICRAIE51050.2020.9358279.
22. Jasim, Marwan Adnan, and Jamal Mustafa AL-Tuwaijari. "Plant Leaf Diseases Detection and Classification Using Image Processing and Deep Learning Techniques." In *2020 International Conference on Computer Science and Software Engineering (CSASE)*, 259–65, 2020. https://doi.org/10.1109/CSASE48920.2020.9142097.

23. Jiang, Ding, Fudong Li, Yuequan Yang, and Song Yu. “A Tomato Leaf Diseases Classification Method Based on Deep Learning.” In *2020 Chinese Control And Decision Conference (CCDC)*, 1446–50, 2020. https://doi.org/10.1109/CCDC49329.2020.9164457.
24. Hong, Huiqun, Jinfa Lin, and Fenghua Huang. “Tomato Disease Detection and Classification by Deep Learning.” In *2020 International Conference on Big Data, Artificial Intelligence and Internet of Things Engineering (ICBAIE)*, 25–29, 2020. https://doi.org/10.1109/ICBAIE49996.2020.00012.
25. “Tomato Leaf Disease Detection Using Deep Learning Techniques.” *International Journal of Advanced Computer Science and Applications* 13, no. 1 (2022).
26. Sholihati, Rizqi Amaliatus, Indra Adji Sulistijono, Anhar Risnumawan, and Eny Kusumawati. “Potato Leaf Disease Classification Using Deep Learning Approach.” In *2020 International Electronics Symposium (IES)*, 392–97, 2020. https://doi.org/10.1109/IES50839.2020.9231784.praj
27. Kibriya, Hareem, Rimsha Rafique, Wakeel Ahmad, and S.M Adnan. “Tomato Leaf Disease Detection Using Convolution Neural Network.” In *2021 International Bhurban Conference on Applied Sciences and Technologies (IBCAST)*, 346–51, 2021. https://doi.org/10.1109/IBCAST51254.2021.9393311.
28. “A Tomato Leaf Diseases Classification Method Based on Deep Learning.” Accessed October 2, 2023. https://ieeexplore.ieee.org/document/9164457/.
29. Hong, Huiqun, Jinfa Lin, and Fenghua Huang. “Tomato Disease Detection and Classification by Deep Learning.” In *2020 International Conference on Big Data, Artificial Intelligence and Internet of Things Engineering (ICBAIE)*, 25–29, 2020. https://doi.org/10.1109/ICBAIE49996.2020.00012.
30. Kaur, Manpreet, and Rekha Bhatia. “Development Of An Improved Tomato Leaf Disease Detection And Classification Method.” In *2019 IEEE Conference on Information and Communication Technology*, 1–5, 2019. https://doi.org/10.1109/CICT48419.2019.9066230.
31. Govardhan, Meghana, and Veena M B. “Diagnosis of Tomato Plant Diseases Using Random Forest.” In *2019 Global Conference for Advancement in Technology (GCAT)*, 1–5, 2019. https://doi.org/10.1109/GCAT47503.2019.8978431.
32. E., Nithish Kannan, Kaushik M., Prakash P., Ajay R., and Veni S. “Tomato Leaf Disease Detection Using Convolutional Neural Network with Data Augmentation.” In *2020 5th International Conference on Communication and Electronics Systems (ICCES)*, 1125–32, 2020. https://doi.org/10.1109/ICCES48766.2020.9138030.
33. “Potato Leaf Disease Classification Using Deep Learning Approach | IEEE Conference Publication | IEEE Xplore.” Accessed December 10, 2023. https://ieeexplore.ieee.org/document/9231784.
34. Asif, Md. Khalid Rayhan, Md. Asfaqur Rahman, and Most. Hasna Hena. “CNN Based Disease Detection Approach on Potato Leaves.” In *2020 3rd International Conference on Intelligent Sustainable Systems (ICISS)*, 428–32, 2020. https://doi.org/10.1109/ICISS49785.2020.9316021.

35. Kathiravan, M., K.Hari Priya, S. Sreesubha, A. Irumporai, V.Sukesh Kumar, and Vishnu Vardhan Reddy. “ML Algorithm-Based Detection of Leaf Diseases.” In *2022 4th International Conference on Smart Systems and Inventive Technology (ICSSIT)*, 1396–1400, 2022. https://doi.org/10.1109/ICSSIT53264.2022.9716430.
36. Hidayatuloh, Akbar, M. Nursalman, and Eki Nugraha. “Identification of Tomato Plant Diseases by Leaf Image Using Squeezenet Model.” In *2018 International Conference on Information Technology Systems and Innovation (ICITSI)*, 199–204, 2018. https://doi.org/10.1109/ICITSI.2018.8696087.
37. https://www.ijres.org/papers/Volume-11/Issue-1/1101548555.pdf
38. Kim, Wan-Soo, Dae-Hyun Lee, and Yong-Joo Kim. “Machine Vision-Based Automatic Disease Symptom Detection of Onion Downy Mildew.” *Computers and Electronics in Agriculture* 168 (January 2020): 105099. https://doi.org/10.1016/j.compag.2019.105099.
39. J., Andrew, Jennifer Eunice, Daniela Elena Popescu, M. Kalpana Chowdary, and Jude Hemanth. “Deep Learning-Based Leaf Disease Detection in Crops Using Images for Agricultural Applications.” *Agronomy* 12, no. 10 (October 2022): 2395. https://doi.org/10.3390/agronomy12102395.

MANAV RACHNA
Vidyanatarikshal

Swami Vivekananda Library and Resource Centre
Manav Rachna University

SIMILARITY VERIFICATION CERTIFICATE

Title: ....DISEASE....DETECTION..IN...VEGETABLE...USING...DEEP..LEARNING .....TECHNIQUE.....

Researcher: ..Jaspreet Kaur

Registration Number : MRUCSDN012K21005

Supervisor: ..Dr. Shalini.....

Department: Computer Science & Technology

This is to certify that the above mentioned Short Synopsis/Thesis was scanned for similarity index through Turnitin.....Software on 15 March 2024 with submission ID 2321238916 and the similarity index was found to be ....6%...%. The complete report running into ..20.. Pages, .4612..Word count with File Size 2574...KB is being forwarded to the Research Supervisor/DRC/DRB for review.

Swami Vivekananda Library and Resource Centre Faridabad * Manav Rachna University *
16/3/24

Date: 16 March 2024

The complete report of the above Short Synopsis/Thesis has been reviewed and the similarity index is below the accepted norms as per the University Grants Commission (Promotion of Academic Integrity and Prevention of Plagiarism in Higher Educational Institutions) Regulations 2018. The Short Synopsis/Thesis may be considered for further processing

16/3/24

Jaspreet Kaur
Research Scholar

Research Supervisor

DISEASE DETECTION IN VEGETABLE USING DEEP LEARNING TECHNIQUES

ORIGINALITY REPORT

6%	2%	5%	0%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

Excluding matches less than 14 words

PRIMARY SOURCES

1	Ramanjot, Usha Mittal, Ankita Wadhawan, Jimmy Singla, N.Z Jhanjhi, Rania M. Ghoniem, Sayan Kumar Ray, Abdelzahir Abdelmaboud. "Plant Disease Detection and Classification: A Systematic Literature Review", Sensors, 2023 Publication	2%
2	"International Conference on Innovative Computing and Communications", Springer Science and Business Media LLC, 2023 Publication	1%
3	shodh.inflibnet.ac.in:8080 Internet Source	1%
4	Md. Iqbal Hossain, Sohely Jahan, Md. Rashid Al Asif, Md. Samsuddoha, Kawsar Ahmed. "Detecting tomato leaf diseases by image processing through deep convolutional neural networks", Smart Agricultural Technology, 2023 Publication	<1%
5	dspace.daffodilvarsity.edu.bd:8080	

	Internet Source	<1%
6	link.springer.com Internet Source	<1%
7	"Advanced Informatics for Computing Research", Springer Science and Business Media LLC, 2021 Publication	<1%
8	Shweta Bondre, Ashish K. Sharma. "Review on Leaf diseases detection using Deep learning", 2021 Second International Conference on Electronics and Sustainable Communication Systems (ICESC), 2021 Publication	<1%

Exclude quotes	Off	Exclude matches	< 14 words
Exclude bibliography	On		